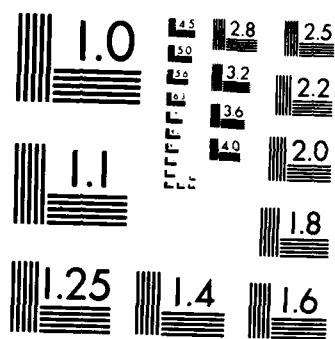


ADA (TRADEMARK) COMPILER VALIDATION SUMMARY REPORT
 ALSYS ALSYCOMP-813 V20 (U) NATIONAL COMPUTING CENTRE
 LTD MANCHESTER (ENGLAND) 30 APR 87

UNCLASSIFIED

F/G 12/5

NL



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

AD-A189 640

AVF Control Number: AVF-VSR-90502/12

Ada* COMPILER
VALIDATION SUMMARY REPORT
ALSYS
AlsyCOMP_013, V2.0
Host: IBM PC AT
Target: IBM 370 3084Q

Completion of On-Site Testing
30 April 1987

Prepared By
The National Computing Centre Limited
Oxford Road
Manchester
M1 7ED
UK

Prepared For
Ada Joint Program Office
United States Department of Defense
Washington, D.C.
USA

DTIC
ELECTE
DEC 28 1987
S H

*Ada is a registered trademark of the United States Government
(Ada Joint Program Office).

DISTRIBUTION STATEMENT A

Approved for public release

87 12 14 163

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	12. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Ada Compiler Validation Summary Report: ALSYS. AlsyCOMP_013, V2.0 Host: IBM PC AT. Target: IBM 370 3084Q		5. TYPE OF REPORT & PERIOD COVERED 30 Apr.'87 to 30 Apr.'88
7. AUTHOR(s) The National Computing Centre Ltd.		6. PERFORMING ORG. REPORT NUMBER
9. PERFORMING ORGANIZATION AND ADDRESS The National Computing Centre Ltd. Oxford Rd., Manchester, M1 7ED, UK		8. CONTRACT OR GRANT NUMBER(s)
11. CONTROLLING OFFICE NAME AND ADDRESS Ada Joint Program Office United States Department of Defense Washington, DC 20301-3081ASD/SIOL		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) The National Computing Centre Ltd.		12. REPORT DATE 30 Apr. '87
		13. NUMBER OF PAGES 58
		15. SECURITY CLASS (of this report) UNCLASSIFIED
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE N/A
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20. If different from Report) UNCLASSIFIED		
18. SUPPLEMENTARY NOTES		
19. KEYWORDS (Continue on reverse side if necessary and identify by block number) Ada Programming language, Ada Compiler Validation Summary Report, Ada Compiler Validation Capability, ACVC, Validation Testing, Ada Validation Office, AVO, Ada Validation Facility, AVF, ANSI/MIL-STD- 1815A, Ada Joint Program Office, AJPO		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) See Attached.		

DD FORM 1473

1 JAN 73

EDITION OF 1 NOV 65 IS OBSOLETE

S/N 0102-LF-014-6601

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

+++++

+
+ Place NTIS form here +
+
+++++

Ada* Compiler Validation Summary Report:

Compiler Name: AlsyCOMP_013, V2.0

Host:

IBM PC AT
under
PC/DOS
3.1

Target:

IBM 370 3084Q
under
MVS
3.2

Testing Completed 30 April 1987 using ACVC 1.8

This report has been reviewed and is approved.



The National Computing Centre Ltd
Vony Gwillim
Oxford Road
Manchester
M1 7ED



Ada Validation Office
Dr. John F. Kramer
Institute for Defense Analyses
Alexandria VA



Ada Joint Program Office
Virginia L. Castor
Director
Department of Defense
Washington DC



Accession For	
NTIS GRA&I	<input checked="" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
By _____	
Distribution/	
Availability Codes	
Dist	Avail and/or Special
A-1	

*Ada is a registered trademark of the United States Government
(Ada Joint Program Office).

EXECUTIVE SUMMARY

This Validation Summary Report (VSR) summarizes the results and conclusions of validation testing performed on the AlsYCOMP_013, V2.0 using Version 1.8 of the Ada* Compiler Validation Capability (ACVC). The AlsYCOMP_013 V2.0, is hosted on a IBM PC AT operating under PC/DOS, V3.1. Programs processed by this compiler may be executed on a IBM 370 3084Q operating under MVS, V3.2. *Keywords: Ada*

On-site testing was performed 27th April 1987 through 30th April 1987 at ALSYS Ltd, Henley-on-Thames, under the direction of the National Computing Centre (AVF), according to Ada Validation Organization (AVO) policies and procedures. The AVF identified 2246 of the 2399 tests in ACVC Version 1.8 to be processed during on-site testing of the compiler. The 19 tests withdrawn at the time of validation testing, as well as the 134 executable tests that make use of floating-point precision exceeding that supported by the implementation were not processed. After the 2246 tests were processed, results for Class A, C, D, or E tests were examined for correct execution. Compilation listings for Class B tests were analyzed for correct diagnosis of syntax and semantic errors. Compilation and link results of Class L tests were analyzed for correct detection of errors. There were 41 of the processed tests determined to be inapplicable; The remaining 2205 tests were passed. *program language*

The results of validation are summarized in the following table:

RESULT	CHAPTER												TOTAL
	2	3	4	5	6	7	8	9	10	11	12	14	
Passed	105	269	352	238	161	97	134	262	121	32	217	217	2205
Failed	0	0	0	0	0	0	0	0	0	0	0	0	0
Inapplicable	11	56	68	9	0	0	5	0	9	0	1	16	175
Withdrawn	0	5	5	0	0	1	1	2	4	0	1	0	19
TOTAL	116	330	425	247	161	98	140	264	134	32	219	233	2399

The AVF concludes that these results demonstrate acceptable conformity to ANSI/MIL-STD-1815A Ada.

*Ada is a registered trademark of the United States Government (Ada Joint Program Office).

TABLE OF CONTENTS

CHAPTER 1	INTRODUCTION	
1.1	PURPOSE OF THIS VALIDATION SUMMARY REPORT	1-2
1.2	USE OF THIS VALIDATION SUMMARY REPORT	1-2
1.3	REFERENCES	1-3
1.4	DEFINITION OF TERMS	1-3
1.5	ACVC TEST CLASSES	1-4
CHAPTER 2	CONFIGURATION INFORMATION	
2.1	CONFIGURATION TESTED	2-1
2.2	IMPLEMENTATION CHARACTERISTICS	2-2
CHAPTER 3	TEST INFORMATION	
3.1	TEST RESULTS	3-1
3.2	SUMMARY OF TEST RESULTS BY CLASS	3-1
3.3	SUMMARY OF TEST RESULTS BY CHAPTER	3-2
3.4	WITHDRAWN TESTS	3-2
3.5	INAPPLICABLE TESTS	3-2
3.6	SPLIT TESTS	3-4
3.7	ADDITIONAL TESTING INFORMATION	3-4
3.7.1	Prevalidation	3-4
3.7.2	Test Method	3-5
3.7.3	Test Site	3-5
APPENDIX A	COMPLIANCE STATEMENT	
APPENDIX B	APPENDIX F OF THE Ada STANDARD	
APPENDIX C	TEST PARAMETERS	
APPENDIX D	WITHDRAWN TESTS	

CHAPTER 1

INTRODUCTION

This Validation Summary Report (VSR) describes the extent to which a specific Ada compiler conforms to the Ada Standard. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability (ACVC). An Ada compiler must be implemented according to the Ada Standard and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard.

Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies--for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from characteristics of particular operating systems, hardware, or implementation strategies. All of the dependencies demonstrated during the process of testing this compiler are given in this report.

The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. The purpose of validating is to ensure conformity of the compiler to the Ada Standard by testing that the compiler properly implements legal language constructs and that it identifies and rejects illegal language constructs. The testing also identifies behaviour that is implementation dependent but permitted by the Ada Standard. Six classes of tests are used. These tests are designed to perform checks at compile time, at link time, and during execution.

INTRODUCTION

1.1 PURPOSE OF THIS VALIDATION SUMMARY REPORT

This VSR documents the results of the validation testing performed on an Ada compiler. Testing was carried out for the following purposes:

- . To attempt to identify any language constructs supported by the compiler that do not conform to the Ada Standard
- . To attempt to identify any unsupported language constructs required by the Ada Standard.
- . To determine that the implementation-dependent behaviour is allowed by the Ada Standard

Testing of this compiler was conducted by NCC under the direction of the AVF according to policies and procedures established by the Ada Validation Organisation (AVO). On-site testing was conducted from 27 April 1987 through 30 April 1987 at ALSYS Ltd, Henley-on-Thames.

1.2 USE OF THIS VALIDATION SUMMARY REPORT

Consistent with the national laws of the originating country, the AVO may make full and free public disclosure of this report. In the United States, this is provided in accordance with the "Freedom of Information Act" (5 U.S.C. 552). The results of this validation apply only to the computers, operating systems, and compiler versions identified in this report.

The organisations represented on the signature page of this report do not represent or warrant that all statements set forth in this report are accurate and complete, or that the subject compiler has no nonconformities to the Ada Standard other than those presented. Copies of this report are available to the public from:

Ada Information Clearinghouse
Ada Joint Program Office
OUSDRE
The Pentagon, Rm 3D-139 (Fern Street)
Washington DC 20301-3081

or from:

Ada Validation Facility
The National Computing Centre Ltd
Oxford Road
Manchester
M1 7ED
United Kingdom

INTRODUCTION

Questions regarding this report or the validation test results should be directed to the AVF listed above or to:

Ada Validation Organization
Institute for Defense Analyses
1801 North Beauregard
Alexandria VA 22311

1.3 REFERENCES

1. Reference Manual for the Ada Programming Language, ANSI/MIL-STD-1815A, FEB 1983.
2. Ada Validation Organization: Policies and Procedures, MITRE Corporation, JUN 1982, PB 83-110601.
3. Ada Compiler Validation Capability Implementer's Guide, SofTech, Inc., DEC 1984.

1.4 DEFINITION OF TERMS

ACVC	The Ada Compiler Validation Capability. A set of programs that evaluates the conformity of a compiler to the Ada language specification, ANSI/MIL-STD-1815A.
Ada Standard	ANSI/MIL-STD-1815A, February 1983.
Applicant	The agency requesting validation.
AVF	The National Computing Centre Ltd. In the context of this report, the AVF is responsible for conducting compiler validations according to established policies and procedures.
AVO	The Ada Validation Organization. In the context of this report, the AVO is responsible for setting procedures for compiler validations.
Compiler	A processor for the Ada language. In the context of this report, a compiler is any language processor, including cross-compilers, translators, and interpreters.
Failed test	A test for which the compiler generates a result that demonstrates nonconformity to the Ada Standard.

INTRODUCTION

Host	The computer on which the compiler resides.
Inapplicable test	A test that uses features of the language that a compiler is not required to support or may legitimately support in a way other than the one expected by the test.
Passed test	A test for which a compiler generates the expected result.
Target	The computer for which a compiler generates code.
Test	A program that checks a compiler's conformity regarding a particular feature or features to the Ada Standard. In the context of this report, the term is used to designate a single test, which may comprise one or more files.
Withdrawn	A test found to be incorrect and not used to check conformity to test the Ada language specification. A test may be incorrect because it has an invalid test objective, fails to meet its test objective, or contains illegal or erroneous use of the language.

1.5 ACVC TEST CLASSES

Conformity to the Ada Standard is measured using the ACVC. The ACVC contains both legal and illegal Ada programs structured into six test classes: A, B, C, D, E, and L. The first letter of a test name identifies the class to which it belongs. Class A, C, D, and E tests are executable, and special program units are used to report their results during execution. Class B tests are expected to produce compilation errors. Class L tests are expected to produce link errors.

Class A tests check that legal Ada programs can be successfully compiled and executed. However, no checks are performed during execution to see if the test objective has been met. For example, a Class A test checks that reserved words of another language (other than those already reserved in the Ada language) are not treated as reserved words by an Ada compiler. A Class A test is passed if no errors are detected at compile time and the program executes to produce a PASSED message.

Class B tests check that a compiler detects illegal language usage. Class B tests are not executable. Each test in this class is compiled and the resulting compilation listing is examined to verify that every syntax or semantic error in the test is detected. A Class B test is passed if every illegal construct that it contains is detected by the compiler.

INTRODUCTION

Class C tests check that legal Ada programs can be correctly compiled and executed. Each Class C test is self-checking and produces a PASSED, FAILED, or NOT APPLICABLE message indicating the result when it is executed.

Class D tests check the compilation and execution capabilities of a compiler. Since there are no requirements placed on a compiler by the Ada Standard for some parameters--for example, the number of identifiers permitted in a compilation or the number of units in a library--a compiler may refuse to compile a Class D test and still be a conforming compiler. Therefore, if a Class D test fails to compile because the capacity of the compiler is exceeded, the test is classified as inapplicable. If a Class D test compiles successfully, it is self-checking and produces a PASSED or FAILED message during execution.

Each Class E test is self-checking and produces a NOT APPLICABLE, PASSED, or FAILED message when it is compiled and executed. However, the Ada Standard permits an implementation to reject programs containing some features addressed by Class E tests during compilation. Therefore, a Class E test is passed by a compiler if it is compiled successfully and executes to produce a PASSED message, or if it is rejected by the compiler for an allowable reason.

Class L tests check that incomplete or illegal Ada programs involving multiple, separately compiled units are detected and not allowed to execute. Class L tests are compiled separately and execution is attempted. A Class L test passes if it is rejected at link time--that is, an attempt to execute the main program must generate an error message before any declarations in the main program or any units referenced by the main program are elaborated.

Two library units, the package REPORT and the procedure CHECK_FILE, support the self-checking features of the executable tests. The package REPORT provides the mechanism by which executable tests report PASSED, FAILED, or NOT APPLICABLE results. It also provides a set of identity functions used to defeat some compiler optimization allowed by the Ada Standard that would circumvent a test objective. The procedure CHECK_FILE is used to check the contents of text files written by some of the Class C tests for chapter 14 of the Ada Standard. The operation of these units is checked by a set of executable tests. These tests produce messages that are examined to verify that the units are operating correctly. If these units are not operating correctly, then the validation is not attempted.

INTRODUCTION

The text of the tests in the ACVC follow conventions that are intended to ensure that the tests are reasonably portable without modification. For example, the tests make use of only the basic set of 55 characters, contain lines with a maximum length of 72 characters, use small numeric values, and place features that may not be supported by all implementations in separate tests. However, some tests contain values that require the test to be customized according to implementation-specific values--for example, an illegal file name. A list of the values used for this validation are listed in Appendix C.

A compiler must correctly process each of the tests in the suite and demonstrate conformity to the Ada Standard either meeting the pass criteria given for the test or by showing that the test is inapplicable to the implementation. Any test that was determined to contain an illegal language construct or an erroneous language construct is withdrawn from the ACVC and, therefore, is not used in testing a compiler. The tests withdrawn at the time of validation are given in Appendix D.

CHAPTER 2

CONFIGURATION INFORMATION

2.1 CONFIGURATION TESTED

The candidate compilation system for this validation was tested under the following configuration:

Compiler: AlsyCOMP_013, V2.0

ACVC Version: 1.8

Certification Expiration Date: DD Month 1988

Host Computer:

Machine :	IBM PC/AT
Operating System:	PC/DOS 3.1
Memory Size:	640K (Main), 4M (Ram disk)

Target Computer:

Machine :	IBM 370 3084Q
Operating System:	MVS 3.2
Memory Size:	2M region

Communications Network:	Ethernet and magnetic tape
-------------------------	----------------------------

2.2 IMPLEMENTATION CHARACTERISTICS

One of the purposes of validating compilers is to determine the behaviour of a compiler in those areas of the Ada Standard that permit implementations to differ. Class D and E tests specifically check for such implementation differences. However, tests in other classes also characterize an implementation. This compiler is characterized by the following interpretations of the Ada Standard:

- . Capacities.

The compiler correctly processes compilations containing loop statements nested to 17 levels, and recursive procedures separately compiled as subunits nested to 17 levels. It correctly processes a compilation containing 723 variables in the same declarative part. (See tests D55A03A..H (8 tests), D56001B, D64005E..G (3 tests), and D29002K.)

- . Universal integer calculations.

An implementation is allowed to reject universal integer calculations having values that exceed `SYSTEM.MAX_INT`. This implementation does not reject such calculations and processes them correctly. (See tests D4A002A, D4A002B, D4A004A, and D4A004B.)

- . Predefined types.

This implementation supports the additional predefined types `SHORT_INTEGER`, `SHORT_FLOAT`, and `LONG_FLOAT`, in the package `STANDARD`. (See tests B86001C and B86001D.)

- . Based literals.

An implementation is allowed to reject a based literal with a value exceeding `SYSTEM.MAX_INT` during compilation, or it may raise `NUMERIC_ERROR` or `CONSTRAINT_ERROR` during execution. This implementation raises `NUMERIC_ERROR` during execution. (See test E24101A.)

- . Array Types.

An implementation is allowed to raise `NUMERIC_ERROR` or `CONSTRAINT_ERROR` for an array having a `'LENGTH'` that exceeds `STANDARD.INTEGER'LAST` and/ or `SYSTEM.MAX_INT`.

A packed `BOOLEAN` array having a `'LENGTH'` exceeding `INTEGER'LAST` raises `NUMERIC_ERROR` when the array type is declared. (See test C52103X.)

CONFIGURATION INFORMATION

A packed two-dimensional BOOLEAN array with more than INTEGER'LAST components raises NUMERIC_ERROR when the array type is declared. (See test C52104Y.)

A null array with one dimension of length greater than INTEGER'LAST may raise NUMERIC_ERROR or CONSTRAINT_ERROR either when declared or assigned. Alternatively, an implementation may accept the declaration. However, lengths must match in array slice assignments. This implementation raises NUMERIC_ERROR when the array type is declared. (See test E52103Y.)

In assigning one-dimensional array types, the expression appears to be evaluated in its entirety before CONSTRAINT_ERROR is raised when checking whether the expression's subtype is compatible with the target's subtype. In assigning two-dimensional array types, the expression does not appear to be evaluated in its entirety before CONSTRAINT_ERROR is raised when checking whether the expression's subtype is compatible with the target's subtype. (See test C52013A.)

. Discriminated types.

During compilation, an implementation is allowed to either accept or reject an incomplete type with discriminants that is used in an access type definition with a compatible discriminant constraint. This implementation accepts such subtype indications during compilation. (See test E38104A.)

In assigning record types with discriminants, the expression appears to be evaluated in its entirety before CONSTRAINT_ERROR is raised when checking whether the expression's subtype is compatible with the target's subtype. (See test C52013A.)

. Aggregates.

In the evaluation of a multi-dimensional aggregate, all choices appear to be evaluated before checking against the index type. (See tests C43207A and C43207B.)

In the evaluation of an aggregate containing subaggregates, all choices are evaluated before being checked for identical bounds. (See test E43212B.)

All choices are evaluated before CONSTRAINT_ERROR is raised if a bound in a nonnull range of a nonnull aggregate does not belong to an index subtype. (See test E43211B.)

. Functions

An implementation may allow the declaration of a parameterless function and an enumeration literal having the same profile in the same immediate scope, or it may reject the function declaration. If it accepts the function declarations, the use of the enumeration literal's identifier denotes the function. This implementation rejects the declarations. (See test E66001D.)

. Representation clauses.

The Ada Standard does not require an implementation to support representation clauses. If a representation clause is not supported, then the implementation must reject it. While the operation of representation clauses is not checked by Version 1.8 of the ACVC, they are used in testing other language features. This implementation rejects 'SIZE and 'STORAGE_SIZE for tasks, 'STORAGE_SIZE for collections, and 'SMALL clauses. Enumeration representation clauses appear not to be supported. (See tests C55B16A, C87B62A, C87B62B, C87B62C, and BC1002A.)

. Pragmas.

The pragma INLINE is not supported for procedures. The pragma INLINE is not supported for functions. (See tests CA3004E and CA3004F.)

. Input/Output.

The package SEQUENTIAL_IO can be instantiated with unconstrained array types and record types with discriminants. The package DIRECT_IO can be instantiated with unconstrained array types and record types with discriminants without defaults, however, USE_ERROR will be raised if IO operations are attempted. (See tests AE2101C, AE2101H, CE2201D, CE2201E, and CE2401D.)

An existing text file can be opened in OUT_FILE mode, can be created in OUT_FILE mode, and can be created in IN_FILE mode. (See test EE3102C.)

Only one internal file can be associated with each external file for text I/O for both reading and writing. (See tests CE3111A.E (5 tests).)

Only one internal file can be associated with each external file for sequential I/O for both reading and writing. (See tests CE2107A..F (6 tests).)

Only one internal file can be associated with each external file for direct I/O for both reading and writing. (See tests CE2107A..F (6 tests).)

CONFIGURATION INFORMATION

Temporary sequential files are given a name. Temporary direct files are given a name. Temporary files given names are not deleted when they are closed. (See tests CE2108A and CE2108C.)

. Generics.

Generic subprogram bodies can only be compiled in separate compilations provided that no instantiations of the corresponding generics occur prior to the compilation of the generic body. (See test CA2009F.)

Generic package bodies can only be compiled in separate compilations provided that no instantiations of the corresponding generics occur prior to the compilation of the generic body. (See tests CA2009C and BC3205D.)

CHAPTER 3
TEST INFORMATION

3.1 TEST RESULTS

Version 1.8 of the ACVC contains 2399 tests. When validation testing of AlsyCOMP_013 was performed, 19 tests had been withdrawn. The remaining 2380 tests were potentially applicable to this validation. The AVF determined that 175 tests were inapplicable to this implementation, and that the 2205 applicable tests were passed by the implementation.

The AVF concludes that the testing results demonstrate acceptable conformity to the Ada Standard.

3.2 SUMMARY OF TEST RESULTS BY CLASS

RESULT	TEST CLASS						TOTAL
	A	B	C	D	E	L	
Passed	68	362	1208	12	11	44	2205
Failed	0	0	0	0	0	0	0
Inapplicable	1	5	160	5	2	2	175
Withdrawn	0	7	12	0	0	0	19
TOTAL	69	874	1380	17	13	46	2399

TEST INFORMATION

3.3 SUMMARY OF TEST RESULTS BY CHAPTER

RESULT	CHAPTER												
	2	3	4	5	6	7	8	9	10	11	12	14	TOTAL
Passed	105	269	352	238	161	97	134	262	121	32	217	229	2205
Failed	0	0	0	0	0	0	0	0	0	0	0	0	0
Inapplicable	11	56	68	9	0	0	5	0	9	0	1	16	175
Withdrawn	0	5	5	0	0	1	1	2	4	0	1	0	19
TOTAL	116	330	425	247	161	98	140	264	134	32	219	233	2399

3.4 WITHDRAWN TESTS

The following 19 tests were withdrawn from ACVC Version 1.8 at the time of this validation:

C32114A	C41404A	B74101B
B33203C	B45116A	C87B50A
C34018A	C48008A	C92005A
C35904A	B49006A	C940ACA
B37401A	B4A010C	CA3005A..D (4 tests)
		BC3204C

See Appendix D for the reason that each of these tests was withdrawn.

3.5 INAPPLICABLE TESTS

Some tests do not apply to all compilers because they make use of features that a compiler is not required by the Ada Standard to support. Others may depend on the result of another test that is either inapplicable or withdrawn. For this validation attempt, 175 tests were inapplicable for the reasons indicated:

- . C34001E, B52004D, B55B09C, and C55B07A use LONG_INTEGER which is not supported by this compiler.
- . C55B16A makes use of an enumeration representation clause containing noncontiguous values which is not supported by this compiler.

TEST INFORMATION

- . B86001D requires a predefined numeric type other than those defined by the Ada language in package STANDARD. There is no such type for this implementation.
- . BA2001E requires that duplicate names of subunits with a common ancestor be detected at compilation time. This compiler correctly detects the error at link time and the AVO rules that such behaviour is acceptable.
- . C86001F redefines package SYSTEM, but TEXT_IO is made obsolete by this new definition in this implementation and the test cannot be executed since the package REPORT is dependent on the package TEXT_IO.
- . C87B62A..C (3 tests) use length clauses to specify the collection size for an access type which is not supported by this compiler. The length clause is rejected during compilation.
- . CA2009C, CA2009F, and BC3205D compile generic subunits in separate compilation files. Separate compilation of generic specifications and bodies is not supported by this compiler when instantiations precede the generic bodies.
- . CA3004E, EA3004C, and LA3004A use INLINE pragma for procedures which is not supported by this compiler.
- . CA3004F, EA3004D, and LA3004B use INLINE pragma for functions which is not supported by this compiler.
- . AE2101H, CE2401D use instantiation of package DIRECT_IO with unconstrained array types which is not supported by this compiler.
- . CE2107A..F (6 tests), CE2110B, CE3111A..E (5 tests), CE3114B and CE3115A attempt to associate more than one external file with the same internal file, which is not supported by this implementation.
- . D55A03E..H (4 tests) contain loops nested to depths > 17. This exceeds the capacity of the implementation.
- . D56001B contains blocks nested to 65 levels. This exceeds the capacity of the implementation.

TEST INFORMATION

- . The following 134 tests make use of floating-point precision that exceeds the maximum of 18 supported by the implementation:

C241130..Y (11 tests)
C357050..Y (11 tests)
C357060..Y (11 tests)
C357070..Y (11 tests)
C357080..Y (11 tests)
C358020..Y (11 tests)
C452410..Y (11 tests)
C453210..Y (11 tests)
C454210..Y (11 tests)
C454240..Y (11 tests)
C455210..Z (12 tests)
C456210..Z (12 tests)

3.6 SPLIT TESTS

If one or more errors do not appear to have been detected in a Class B test because of compiler error recovery, then the test is split into a set of smaller tests that contain the undetected errors. These splits are then compiled and examined. The splitting process continues until all errors are detected by the compiler or until there is exactly one error per split. Any Class A, Class C, or Class E test that cannot be compiled and executed because of its size is split into a set of smaller subsets that can be processed.

Splits were required for 17 Class B tests.

B32202A	B45102A	B95069A
B32202B	B61012A	B95069B
B32202C	B62001B	BC3204D
B33001A	B62001C	BC3205C
B37004A	B62001D	BC3205D
B43201D	B91004A	

3.7 ADDITIONAL TESTING INFORMATION

3.7.1 Prevalidation

Prior to validation, a set of test results for ACVC Version 1.8 produced by AlsYCOMP_013, was submitted to the AVF by the applicant for review. Analysis of these results demonstrated that the compiler successfully passed all applicable tests, and the compiler exhibited the expected behaviour on all inapplicable tests.

TEST INFORMATION

3.7.2 Test Method

Testing of AlsyCOMP_013 using ACVC Version 1.8 was conducted on-site by a validation team from the AVF. The configuration consisted of two IBM PC-ATs operating under PC/DOS, V3.1, and a IBM 370 3084Q target operating under MVS, V3.2. The host and target computers were linked via magnetic tape.

A magnetic tape containing all tests was taken on-site by the validation team for processing. The magnetic tape contained tests that make use of implementation-specific values were customized before being written to the magnetic tape. Tests requiring splits during the prevalidation testing were not included in their split form on the magnetic tape. The contents of the magnetic tape were loaded first onto a VAX 750 computer, where the required splits were performed using the VAX editor (EDT) driven by prepared command scripts. The processed source files were then transferred to the host computers via an Ethernet connection.

After the test files were loaded to disk, the full set of tests was compiled and linked on the IBM PC-AT, and all executable tests were run on the IBM 370 3084Q. Object files were bound on the host computer, and bound object modules were transferred to the target computer via magnetic tape. Bound object modules were linked on the target computer and run. Results were transferred to and printed from a VAX 750 via a SUN-3/160 connected to the target by a data-link using SNA protocol.

The compiler was tested using command scripts provided by ALSYS Ltd and reviewed by the validation team. Tests were compiled, linked and executed (as appropriate) using two host computers and a single target computer. Test output, compilation listings, and job logs were captured on magnetic tape and archived at AVF. The listings examined on-site by the validation team were also archived.

3.7.3 Test Site

The validation team arrived at ALSYS Ltd, Henley-on-Thames on 27th April 1987 and departed after testing was completed on 30th April 1987.

APPENDIX A

COMPLIANCE STATEMENT

ALSYS Ltd has submitted the following
compliance statement concerning the
AlsyCOMP_013, V2.0.

COMPLIANCE STATEMENT

Compliance Statement

Base Configuration:

Compiler: AlsyCOMP_013, V2.0

Test Suite: Ada* Compiler Validation Capability, Version 1.8

Host Computer:

Machine: IBM PC/AT

Operating System: PC/DOS
3.1

Target Computer:

Machine: IBM 370 3084Q

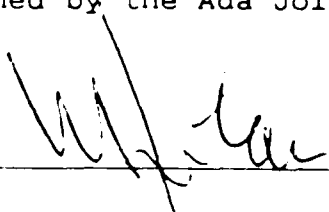
Operating System: MVS
3.2

Communications Network: Ethernet and magnetic tape

ALSYS Ltd. has made no deliberate extensions to the Ada language standard.

ALSYS Ltd. agrees to the public disclosure of this report.

ALSYS Ltd. agrees to comply with the Ada trademark policy, as defined by the Ada Joint Program Office.



ALSYS Ltd
M L J Jordan
Marketing Director

Date:

30/4/87

*Ada is registered trademark of the United States Government
(Ada Joint Program Office).

APPENDIX B

APPENDIX F OF THE Ada STANDARD

The only allowed implementation dependencies correspond to implementation-dependent pragmas, to certain machine-dependent conventions as mentioned in chapter 13 of MIL-STD-1815A, and to certain allowed restrictions on representation classes. The implementation-dependent characteristics of the AlsyCOMP_013, V1.0 are described in the following sections which discuss topics one through eight as stated in Appendix F of the Ada Language Reference Manual (ANSI/MIL-STD-1815A). The implementation-specific portions of the package STANDARD are also included in this appendix.

Package STANDARD is

...

```
type INTEGER is -2_147_483_648 .. 2_147_483_647 ;
type SHORT_INTEGER is range -32_768 .. 32_767 ;

type FLOAT is digits 15 range -(1.0-2.0**-56)*2.0**252 ..
                                (1.0-2.0**-56)*2.0**252;
type SHORT_FLOAT is digits 6 range
    -(1.0-2.0**-24)*2.0**252 .. (1.0-2.0**-24)*2.0**252 ;
type LONG_FLOAT is digits 18 range
    -(1.0-2.0**-112)*2.0**252 .. (1.0-2.0**-112)*2.0**252 ;
type DURATION is delta 1.0E-4 range -86400.0 .. 86400.0 ;
```

end STANDARD;

Alsys IBM 370 Ada* Compiler

Appendix F Implementation - Dependent Characteristics

Version 2.0

Alsys S.A.
29, Avenue de Versailles
78170 La Celle St. Cloud, France

Alsys, Inc.
1432 Main Street
Waltham, MA 02154, U.S.A.

Alsys Ltd.
Partridge House, Newtown Road
Henley-on-Thames,
Oxfordshire RG9 1EN, U.K.

* Ada is a registered trademark of the U.S. Government, Ada Joint Program Office

Copyright 1987 by Alsys

All rights reserved. No part of this document may be reproduced in any form or by any means without permission in writing from Alsys.

Printed: April 1987

Alsys reserves the right to make changes in specifications and other information contained in this publication without prior notice. Consult Alsys to determine whether such changes have been made.

PREFACE

This *Alsys IBM 370 Ada Compiler Appendix F* is for programmers, software engineers, project managers, educators and students who want to develop an Ada program for any IBM System 370 (30XX or 43XX) processor that runs MVS.

This appendix is a required part of the *Reference Manual for the Ada Programming Language*, ANSI MIL-STD 1815A, February 1983 (throughout this appendix, citations in square brackets refer to this manual). It assumes that the user is already familiar with the MVS operating system, and has access to the following IBM documents:

OS/VS2 MVS Overview, GC28-0984

OS/VS2 System Programming Library: Job Management, GC28-1303

OS/VS2 MVS JCL, GC28-1350

IBM System/370: Principles of Operation, GA22-7000

IBM System/370 System Summary, GA22-7001

TABLE OF CONTENTS

APPENDIX F	1
1 Implementation-Dependent Pragmas	1
1.1 INTERFACE	1
Calling Conventions	2
Parameter-Passing Conventions	3
Parameter Representations	3
Restrictions on Interfaced Subprograms	5
1.2 INTERFACE_NAME	5
1.3 Other Pragmas	6
2 Implementation-Dependent Attributes	6
3 Specification of the Package SYSTEM	6
4 Restrictions on Representation Clauses	7
5 Conventions for Implementation-Generated Names	7
6 Address Clauses	7
7 Restrictions on Unchecked Conversions	8
8 Input-Output Packages	8
8.1 Specifying External Files	8
Files	8
FORM Parameter	9
8.2 Text Terminators	11
8.3 EBCDIC and ASCII	12
8.4 Package OS_ENV	21
9 Characteristics of Numeric Types	22
9.1 Integer Types	22
9.2 Floating Point Type Attributes	23
SHORT_FLOAT	23
FLOAT	23
LONG_FLOAT	24
9.3 Attributes of Type DURATION	24
10 Other Implementation-Dependent Characteristics	24
10.1 Characteristics of the Heap	24
10.2 Characteristics of Tasks	25
10.3 Definition of a Main Program	25
10.4 Ordering of Compilation Units	25
11 Limitations	26
11.1 Compiler Limitations	26

Appendix F

Implementation-Dependent Characteristics

This appendix summarises the implementation-dependent characteristics of the Alsys IBM 370 Ada Compiler.

The sections of this appendix are as follows:

1. The form, allowed places, and effect of every implementation-dependent pragma.
2. The name and type of every implementation-dependent attribute.
3. The specification of the package SYSTEM.
4. The list of all restrictions on representation clauses.
5. The conventions used for any implementation-generated names denoting implementation-dependent components.
6. The interpretation of expressions that appear in address clauses, including those for interrupts.
7. Any restrictions on unchecked conversions.
8. Any implementation-dependent characteristics of the input-output packages.
9. Characteristics of numeric types.
10. Other implementation-dependent characteristics.
11. Compiler limitations.

The name *Ada Run-Time Executive* refers to the run-time library routines provided for all Ada programs. These routines implement the Ada heap, exceptions, tasking control, and other utility functions.

1 Implementation-Dependent Pragmas

Ada programs can interface with subprograms written in assembler or other languages through the use of the predefined pragma `INTERFACE` [13.9] and the implementation-defined pragma `INTERFACE_NAME`.

1.1 INTERFACE

Pragma `INTERFACE` specifies the name of an interfaced subprogram and the name of the programming language for which calling and parameter passing conventions

will be generated. Pragma INTERFACE takes the form specified in the *Reference Manual*.

```
pragma INTERFACE (language_name, subprogram_name);
```

where

- *language_name* is the name of the other language whose calling and parameter passing conventions are to be used.
- *subprogram_name* is the name used within the Ada program to refer to the interfaced subprogram.

The only language name currently accepted by pragma INTERFACE is ASSEMBLER.

The language name used in the pragma INTERFACE does not necessarily correspond to the language used to write the interfaced subprogram. It is used only to tell the Compiler how to generate subprogram calls, that is, which calling conventions and parameter passing techniques to use. ASSEMBLER is used to refer to the standard IBM 370 calling and parameter passing conventions. The programmer can use the language name ASSEMBLER to interface Ada subprograms with subroutines written in any language that follows the standard IBM 370 calling conventions.

Calling Conventions

The contents of all of the general purpose registers must be left unchanged by the call, except register 0, which is used for returning results. On entry to the subprogram, register 13 contains the address of a register save area provided by the caller.

Registers 15 and 14 contain the entry point address and return address, respectively, of the called subprogram.

An interfaced subprogram should have the following structure:

```
STM R14,R12,12(R13)      -- save registers
                          --
                          -- subprogram body
                          --
LM R14,R12,12(R13)       -- restore registers
BR R14                  -- return to caller
```

Any registers which are altered by the execution of the subprogram should be saved as the first action upon entry to the subprogram, using a single ST or STM instruction. This enables the Ada Run-Time Executive to treat any interruption occurring during the execution of the body of the subprogram as the implementation-defined Ada exception SPURIOUS_ERROR being raised at the point of call of the subprogram. This exception is not visible outside the Ada Run-Time Executive, and hence cannot be handled by the Ada program.

Parameter-Passing Conventions

On entry to the subprogram, register 1 contains the address of a parameter address list. Each word in this list is an address corresponding to a parameter. The last word in the list has its bit 0 (sign bit) set.

For actual parameters which are literal values, the address is that of a copy of the value of the parameter; for all other parameters it is the address of the parameter object. Interfaced subprograms have no notion of parameter modes; hence parameters whose addresses are passed are not protected from modification by the subprogram, even though they may be formally declared to be of mode **in**.

No consistency checking is performed between the subprogram parameters declared in Ada and the corresponding parameters of the interfaced subprogram. It is the programmer's responsibility to ensure correct access to the parameters.

Parameter Representations

This section describes the representation of values of the types that can be passed as parameters to an interfaced subprogram.

Integer Types [3.5.4]

Ada integer types occupy 16 (SHORT_INTEGER) or 32 (INTEGER) bits. An INTEGER subtype falling within the range of SHORT_INTEGER is implemented as a SHORT_INTEGER in 16 bits.

Enumeration Types [3.5.1]

Values of an Ada enumeration type are represented internally as unsigned values representing their position in the list of enumeration literals defining the type. The first literal in the list corresponds to a value of zero.

Enumeration types with 256 elements or fewer are represented in 8 bits, those with more than 256 elements in 16 bits. The maximum number of values an enumeration type can include is $65536 (2^{16})$.

The ADA predefined type CHARACTER [3.5.2] is represented in 8 bits, using the standard ASCII codes [C].

Floating Point Types [3.5.7, 3.5.8]

Ada floating-point values occupy 32 (SHORT_FLOAT), 64 (FLOAT) or 128 (LONG_FLOAT) bits, and are held in IBM 370 (short, long or extended floating point) format.

Fixed Point Types [3.5.9, 3.5.10]

Ada fixed-point types are managed by the Compiler as the product of a signed *mantissa* and a constant *small*. The mantissa is implemented as a 16 or 32 bit integer value. *Small* is a compile-time quantity which is the power of two equal or immediately inferior to the delta specified in the declaration of the type.

The attribute MANTISSA is defined as the smallest number such that:

$$2^{**} \text{ MANTISSA} \geq \max (\text{abs} (\text{upper_bound}), \text{abs} (\text{lower_bound})) / \text{small}$$

The size of a fixed point type is:

MANTISSA	Size
1 .. 15	16 bits
16 .. 31	32 bits

Fixed point types requiring a MANTISSA greater than 31 are not supported.

Access Types [3.8]

Values of access types are represented internally by the 31-bit address of the designated object. Note that bit 0 (the sign bit) of the 32-bit word holding a non-null access value may be set or clear, depending upon certain conventions used by the Ada Run-Time Executive, and must be preserved. The value zero is used to represent null.

Array Types [3.6]

Ada arrays are passed by reference; the value passed is the address of the first element of the array. When an array is passed as a parameter to an interfaced subprogram, the usual consistency checking between the array bounds declared in the calling program and the subprogram is not enforced. It is the programmer's responsibility to ensure that the subprogram does not violate the bounds of the array.

Values of the predefined type STRING [3.6.3] are arrays, and are passed in the same way: the address of the first character in the string is passed. Elements of a string are represented in 8 bits, using the standard ASCII codes.

Record Types [3.7]

Ada records are passed by reference, by passing the address of the first component of the record. However, unlike arrays, the individual components of a record may be reordered internally by the Ada compiler. Moreover, if a record contains discriminants or components having a dynamic size, implicit components may be added to the record. Thus the exact internal structure of the record in memory may not be inferred directly from its Ada declaration.

Restrictions on Interfaced subprograms

The Ada Run-Time Executive uses the SPIE (SVC 14) macro. Interfaced subprograms should avoid use of this facility, or else restore interruption processing to its original state before returning to the Ada program. Failure to do so may lead to unpredictable results.

Similarly, interfaced subprograms must not change the program mask in the Program Status Word (PSW) of the machine without restoring it before returning.

1.2 INTERFACE_NAME

Pragma `INTERFACE_NAME` associates the name of an interfaced subprogram, as declared in Ada, with its name in the language of origin. If pragma `INTERFACE_NAME` is not used, then the two names are assumed to be identical. This pragma takes the form

```
pragma INTERFACE_NAME (subprogram_name, string_literal);
```

where

- *subprogram_name* is the name used within the Ada program to refer to the interfaced subprogram.
- *string_literal* is the name by which the interfaced subprogram is referred to at link-time.

The use of `INTERFACE_NAME` is optional, and is not needed if a subprogram has the same name in Ada as in the language of origin. It is useful, for example, if the name of the subprogram in its original language contains characters that are not permitted in Ada identifiers. Ada identifiers can contain only letters, digits and underscores, whereas the IBM 370 linkage editor/loader allows external names to contain other characters, e.g. the plus or minus sign. These characters can be specified in the *string_literal* argument of the pragma `INTERFACE_NAME`.

The pragma `INTERFACE_NAME` is allowed at the same places of an Ada program as the pragma `INTERFACE` [13.9]. However, the pragma `INTERFACE_NAME` must always occur after the pragma `INTERFACE` declaration for the interfaced subprogram.

In order to conform to the naming conventions of the IBM 370 linkage editor/loader, the link-time name of an interfaced subprogram will be truncated to 8 characters and converted to upper case.

The Ada Run-Time Executive contains several external identifiers. All such identifiers begin with the string "ALSYS". Accordingly, names prefixed by "ALSYS", in any combination of upper and lower case, should be avoided by the user.

Example

```
package SAMPLE_DATA is
  function SAMPLE_DEVICE (X : INTEGER) return INTEGER;
  function PROCESS_SAMPLE (X : INTEGER) return INTEGER;
private
  pragma INTERFACE (ASSEMBLER, SAMPLE_DEVICE);
  pragma INTERFACE (ASSEMBLER, PROCESS_SAMPLE);
  pragma INTERFACE_NAME (PROCESS_SAMPLE, "PSAMPLE");
end SAMPLE_DATA;
```

1.3 Other Pragmas

No other implementation-dependent pragmas are supported in the current version of this compiler.

2 Implementation-Dependent Attributes

There are no implementation-dependent attributes.

3 Specification of the Package SYSTEM

```
package SYSTEM is

  type NAME is (IBM_370);

  SYSTEM_NAME : constant NAME := NAME'FIRST;
  MIN_INT      : constant := -(2**31);
  MAX_INT      : constant := 2**31-1;
  MEMORY_SIZE  : constant := 2**24;

  type ADDRESS is range MIN_INT .. MAX_INT;

  STORAGE_UNIT : constant := 8;
  MAX_DIGITS    : constant := 18;
  MAX_MANTISSA  : constant := 31;
  FINE_DELTA    : constant := 2#1.0#e-31;
  TICK          : constant := 0.01;
  NULL_ADDRESS  : constant ADDRESS := 0;

  subtype PRIORITY is INTEGER range 1 .. 10;

  -- These subprograms are provided to perform
  -- READ/WRITE operations in memory.

  generic
    type ELEMENT_TYPE is private;
  function FETCH (FROM : ADDRESS) return ELEMENT_TYPE;
```

```

        type ELEMENT_TYPE is private;
        procedure STORE (INTO ADDRESS, OBJECT ELEMENT_TYPE)

    end SYSTEM;

```

The generic function FETCH may be used to read data objects from given addresses in store. The generic procedure STORE may be used to write data objects to given addresses in store.

4 Restrictions on Representation Clauses

Representation clauses [13.1] are not supported by this version of the Alsys IBM 370 Ada Compiler. Any program containing a representation clause is rejected at compilation time. The pragma PACK [13.1] is also not supported. However, its presence in a program does not in itself make the program illegal; the Compiler will simply issue a warning message and ignore the pragma.

5 Conventions for Implementation-Generated Names

There are no implementation-generated names [13.4] in the current version of the Alsys IBM 370 Ada Compiler.

The following predefined library units cannot be recompiled:

```

    ALSYS_ADA_RUNTIME
    ALSYS_BASIC_IO
    ALSYS_BINARY_IO
    ALSYS_COMMON_IO
    ALSYS_FILE_MANAGEMENT
    ALSYS_SYS_IO
    CALENDAR
    DIRECT_IO
    EBCDIC
    IO_EXCEPTIONS
    OS_ENV
    SEQUENTIAL_IO
    STANDARD
    SYSTEM
    TEXT_IO
    UNCHECKED_CONVERSION
    UNCHECKED_DEALLOCATION

```

6 Address Clauses

Address clauses [13.5] are not supported in this version of the Alsys IBM 370 Ada Compiler.

7 Restrictions on Unchecked Conversions

Unchecked conversions [13.10.2] are allowed only between types which have the same value for their 'SIZE' attribute.

8 Input-Output Packages

The predefined input-output packages `SEQUENTIAL_IO` [14.2.3], `DIRECT_IO` [14.2.5], and `TEXT_IO` [14.3.10] are implemented as described in the Language Reference Manual, as is the package `IO_EXCEPTIONS` [14.5], which specifies the exceptions that can be raised by the predefined input-output packages.

The package `LOW_LEVEL_IO` [14.6], which is concerned with low-level machine-dependent input-output, has not been implemented.

8.1 Specifying External Files

The `NAME` parameter supplied to the Ada procedure `CREATE` [14.2.1] must represent an MVS dataset name (DSNAME). The `NAME` parameter supplied to the `OPEN` procedure [14.2.1] may represent a DSNAME or a DDNAME.

Files

An MVS dataset name as specified in the Ada `NAME` parameter may be given in any of the following forms:

```
OPEN (F, NAME => "UNQUALIFIED.NAME", ...);
```

```
OPEN (F, NAME => "FULLY.QUALIFIED.NAME", ...);
```

```
OPEN (F, NAME => "UNQUALIFIED.PDS (MEMBER)", ...);
```

```
OPEN (F, NAME => "FULLY.QUALIFIED.PDS (MEMBER)", ...);
```

An unqualified name (not enclosed in apostrophes) is first prefixed by the name (if any) given as the `QUALIFIER` parameter in the program `PARM` string when the program is run.

The `QUALIFIER` parameter may be specified as in the following example:

```
//STEP20 EXEC PGM=IEB73,PARM='QUALIFIER(PAYROLL.ADA)'
```

A fully qualified name (enclosed in single quotes) is not so prefixed. The result of the `NAME` function is always in the form of a fully qualified name, i.e. enclosed in apostrophes.

Members of partitioned datasets are specified within parentheses.

The file name parameter may also be a DDNAME (see below) in the case of `OPEN`.

FORM Parameter

The FORM parameter comprises a (possibly empty) set of attributes (the FORM parameter may, of course, be given as a null string [14.2.1]) formulated according to the lexical rules of [2], separated by commas. Attributes are comma-separated; blanks may be inserted between lexical elements as desired. In the descriptions below the meanings of *natural*, *positive*, etc., are as in Ada; attribute keywords (represented in upper case) are identifiers [2.3] and as such may be specified without regard to case.

USE_ERROR is raised if the FORM parameter is illegal.

The attributes are as follows:

File sharing attribute

This attribute allows control over the sharing of one external file between several internal files within a single program. In effect it establishes rules for subsequent OPEN and CREATE calls which specify the same external file. If such rules are violated or if a different file sharing attribute is specified in a later OPEN or CREATE call, USE_ERROR will be raised. The syntax is as follows:

NOT_SHARED | SHARED => *access_mode*

where

access_mode ::= READERS | SINGLE_WRITER | ANY

A file sharing attribute of:

NOT_SHARED

implies only one internal file may access the external file.

SHARED => READERS

imposes no restrictions on internal files of mode IN_FILE, but prevents any internal files of mode OUT_FILE or INOUT_FILE being associated with the external file.

SHARED => SINGLE_WRITER

is as SHARED => READERS, but in addition allows a single internal file of mode OUT_FILE or INOUT_FILE.

SHARED => ANY

places no restrictions on external file sharing.

The default is SHARED => NOT_SHARED.

Record size attribute

By default, records are output according to the following rules:

- for `TEXT_IO` and `SEQUENTIAL_IO`, variable-length record files (`RECFM = V`).
- for `DIRECT_IO`, fixed-length record files (`RECFM = F`).

In the case of `DIRECT_IO` for constrained types the record size is determined by the size of the type with which the package is instantiated. The user can specify the record size attribute to force the representation of the Ada element in output records of a given byte size. Of course, such a specified record size must not be smaller than `ELEMENT_TYPE'SIZE / SYSTEM.STORAGE_UNIT`; `DATA_ERROR` will be raised if this rule is violated.

There is just one case in which the record size attribute is mandatory, that of `DIRECT_IO` for mode `OUT_FILE` or `INOUT_FILE` for unconstrained types. In the absence of the record size attribute in this case, `USE_ERROR` will be raised (although the package may be instantiated without error).

If the record size attribute is specified, fixed-length records (`RECFM = F`) will be generated.

In the case of `TEXT_IO`, output lines will be padded to the requisite length with spaces; this fact should be borne in mind when re-reading files generated using `TEXT_IO` with the record size attribute set.

In the case of `DIRECT_IO` of unconstrained types, the length of each item precedes the binary image of the item itself in the external file; it is held in 2 or 4 bytes depending on the maximum size of the item.

The syntax of the record size attribute is as follows:

`RECORD_SIZE => natural`

where *natural* is a size in bytes.

The default is

`RECORD_SIZE => ELEMENT_TYPE'SIZE / SYSTEM.STORAGE_UNIT`

for `DIRECT_IO` of constrained types.

`RECORD_SIZE => 0`

(meaning variable-length records) otherwise.

Carriage control

This attribute applies to `TEXT_IO` only, and is intended for files destined to be sent to a printer.

For a file of mode `OUT_FILE`, this attribute causes the output procedures of `TEXT_IO` to place a carriage control character as the first character of every output record: '1' (skip to channel 1) if the record follows a page terminator, or blank (skip to next line) otherwise. Subsequent characters are output as normal as the result of calls of the output subprograms of `TEXT_IO`.

For a file of mode `IN_FILE`, this attribute causes the input procedures of `TEXT_IO` to interpret the first character of each record as a carriage control character, as described in the previous paragraph. Carriage control characters are not explicitly returned as a result of an input subprogram, but will (for example) affect the result of `END_OF_PAGE`.

The user should naturally be careful to ensure the carriage control attribute of a file of mode `IN_FILE` has the same value as that specified when creating the file.

The syntax of the carriage control attribute is as follows:

`CARRIAGE_CONTROL => boolean`

The default is `CARRIAGE_CONTROL => FALSE`.

DDNAME attribute

This attribute affects the semantics of the `NAME` parameter.

If the `DDNAME` attribute is specified, the `NAME` parameter is taken to be the name of a `DD` statement which the user must have provided in the `JCL` to run the Ada program.

`CREATE` will raise `USE_ERROR` if the `DDNAME` attribute is specified in its `FORM` parameter.

If `DELETE` is called for a file opened with the `DDNAME` attribute of the `FORM` parameter having been specified, `USE_ERROR` will be raised, but the file will be closed.

The syntax of the `DDNAME` attribute is as follows:

`DDNAME => boolean`

The default is `DDNAME => FALSE`.

8.2 Text Terminators

Line terminators [14.3] are not implemented using a character, but are implied by the end of physical record.

Page terminators [14.3] are implemented using the EBCDIC character 0C (hexadecimal).

File terminators [14.3] are not implemented using a character, but are implied by the end of physical file.

The user should avoid the explicit output of the character ASCII_FF [C]. If the user explicitly outputs the character ASCII_LF, this is treated as a call of NEW_LINE [14.3.4].

8.3 EBCDIC and ASCII

All I/O using TEXT_IO is performed using ASCII/EBCDIC translation. CHARACTER and STRING values are held internally in ASCII but represented in external files in EBCDIC. For SEQUENTIAL_IO and DIRECT_IO no translation takes place, and the external file contains a binary image of the internal representation of the Ada element.

It should be noted that the EBCDIC character set is larger than the (7 bit) ASCII and that the use of EBCDIC and ASCII control characters may not produce the desired results when using TEXT_IO (the input and output of control characters is in any case not defined by the Ada language [14.3]). Furthermore, the user is advised to exercise caution in the use of BAR (|) and SHARP (#), which are part of the lexis of Ada; if their use is prevented by translation between ASCII and EBCDIC, EXCLAM (!) and COLON (:), respectively, should be used instead [2.10].

Various translation tables exist to translate between ASCII and EBCDIC. The predefined package EBCDIC is provided to allow access to the translation facilities used by TEXT_IO and OS_ENV.

The specification of this package is as follows:

```
package EBCDIC is

  type EBCDIC_CHARACTER is (
    nul,           -- 0 = 0h
    soh,           -- 1 = 1h
    stx,           -- 2 = 2h
    etx,           -- 3 = 3h
    E_4,
    ht,            -- 5 = 5h
    E_6,
    del,           -- 7 = 7h
    E_8,
    E_9,
    E_A,
    vt,            -- 11 = 0Bh
    ep,            -- 12 = 0Ch
    cr,            -- 13 = 0Dh
    so,            -- 14 = 0Eh
    si,            -- 15 = 0Fh
    die,           -- 16 = 10h
    dc1,           -- 17 = 11h
    dc2,           -- 18 = 12h
```

dc3,	-- 19 = 13h
E_14,	
nl,	-- 21 = 15h
bs,	-- 22 = 16h
E_17,	
can,	-- 24 = 18h
em,	-- 25 = 19h
E_1A,	
E_1B,	
E_1C,	
gs,	-- 29 = 1Dh
rs,	-- 30 = 1Eh
us,	-- 31 = 1Fh
E_20,	
E_21,	
fs,	-- 34 = 22h
E_23,	
E_24,	
E_25,	
etb,	-- 38 = 26h
esc,	-- 39 = 27h
E_28,	
E_29,	
E_2A,	
E_2B,	
E_2C,	
enq,	-- 45 = 2Dh
ack,	-- 46 = 2Eh
bel,	-- 47 = 2Fh
E_30,	
E_31,	
syn,	-- 50 = 32h
E_33,	
E_34,	
E_35,	
E_36,	
eot,	-- 55 = 37h
E_38,	
E_39,	
E_3A,	
E_3B,	
dc4,	-- 60 = 3Ch
nak,	-- 61 = 3Dh
E_3E,	
sub,	-- 63 = 3Fh
sp,	-- 64 = 40h
E_41,	
E_42,	
E_43,	
E_44,	
E_45,	
E_46,	

E_47,	
E_48,	
E_49,	
E_4A,	
'	-- 75 = 4Bh
'<'	-- 76 = 4Ch
'('	-- 77 = 4Dh
'+'	-- 78 = 4Eh
']'	-- 79 = 4Fh
'&'	-- 80 = 50H
E_51,	
E_52,	
E_53,	
E_54,	
E_55,	
E_56,	
E_57,	
E_58,	
E_59,	
'"	-- 90 = 5Ah
'\$'	-- 91 = 5Bh
'*'	-- 92 = 5Ch
')	-- 93 = 5Dh
'	-- 94 = 5Eh
'	-- 95 = 5Fh
'	-- 96 = 60h
'/'	-- 97 = 61h
E_62,	
E_63,	
E_64,	
E_65,	
E_66,	
E_67,	
E_68,	
E_69,	
E_6A,	
'	--107 = 6Bh
'%	--108 = 6Ch
'	--109 = 6Dh
'>'	--110 = 6Eh
'	--111 = 6Fh
E_70,	
E_71,	
E_72,	
E_73,	
E_74,	
E_75,	
E_76,	
E_77,	
E_78,	
'	--121 = 79h
'	--122 = 7Ah

'#',	--123 = 7Bh
'@',	--124 = 7Ch
'+',	--125 = 7Dh
'=',	--126 = 7Eh
'+',	--127 = 7Fh
E_80,	
'a',	--129 = 81h
'b',	--130 = 82h
'c',	--131 = 83h
'd',	--132 = 84h
'e',	--133 = 85h
'f',	--134 = 86h
'g',	--135 = 87h
'h',	--136 = 88h
'i',	--137 = 89h
E_8A,	
E_8B,	
E_8C,	
E_8D,	
E_8E,	
E_8F,	
E_90,	
'j',	--145 = 91h
'k',	--146 = 92h
'l',	--147 = 93h
'm',	--148 = 94h
'n',	--149 = 95h
'o',	--150 = 96h
'p',	--151 = 97h
'q',	--152 = 98h
'r',	--153 = 99h
E_9A,	
E_9B,	
E_9C,	
E_9D,	
E_9E,	
E_9F,	
E_A0,	
'-',	--161 = 0A1h
's',	--162 = 0A2h
't',	--163 = 0A3h
'u',	--164 = 0A4h
'v',	--165 = 0A5h
'w',	--166 = 0A6h
'x',	--167 = 0A7h
'y',	--168 = 0A8h
'z',	--169 = 0A9h
E_AA,	
E_AB,	
E_AC,	
'[',	--173 = 0ADh
E_AE,	

E_AF,	
E_B0,	
E_B1,	
E_B2,	
E_B3,	
E_B4,	
E_B5,	
E_B6,	
E_B7,	
E_B8,	
E_B9,	
E_BA,	
E_BB,	
E_BC,	
' ',	--189 = 0BDh
E_BE,	
E_BF,	
'{',	--192 = 0C0h
'A',	--193 = 0C1h
'B',	--194 = 0C2h
'C',	--195 = 0C3h
'D',	--196 = 0C4h
'E',	--197 = 0C5h
'F',	--198 = 0C6h
'G',	--199 = 0C7h
'H',	--200 = 0C8h
'I',	--201 = 0C9h
E_CA,	
E_CB,	
E_CC,	
E_CD,	
E_CE,	
E_CF,	
'}',	--208 = 0D0h
'J',	--209 = 0D1h
'K',	--210 = 0D2h
'L',	--211 = 0D3h
'M',	--212 = 0D4h
'N',	--213 = 0D5h
'O',	--214 = 0D6h
'P',	--215 = 0D7h
'Q',	--216 = 0D8h
'R',	--217 = 0D9h
E_DA,	
E_DB,	
E_DC,	
E_DD,	
E_DE,	
E_DF,	
'\',	--224 = 0E0h
E_E1,	
'S',	--226 = 0E2h

```

'T',          --227 = 0E3h
'U',          --228 = 0E4h
'V',          --229 = 0E5h
'W',          --230 = 0E6h
'X',          --231 = 0E7h
'Y',          --232 = 0E8h
'Z',          --233 = 0E9h
E_EA,
E_EB,
E_EC,
E_ED,
E_EE,
E_EF,
'0',          --240 = 0F0h
'1',          --241 = 0F1h
'2',          --242 = 0F2h
'3',          --243 = 0F3h
'4',          --244 = 0F4h
'5',          --245 = 0F5h
'6',          --246 = 0F6h
'7',          --247 = 0F7h
'8',          --248 = 0F8h
'9',          --249 = 0F9h
E_FA,
E_FB,
E_FC,
E_FD,
E_FE,
E_FF);

```

```

SEL      : constant EBCDIC_CHARACTER := E_4;
RNL      : constant EBCDIC_CHARACTER := E_6;
GE       : constant EBCDIC_CHARACTER := E_8;
SPS      : constant EBCDIC_CHARACTER := E_9;
RPT      : constant EBCDIC_CHARACTER := E_A;
RES      : constant EBCDIC_CHARACTER := E_4;
ENP      : constant EBCDIC_CHARACTER := E_4;
POC      : constant EBCDIC_CHARACTER := E_17;
UBS      : constant EBCDIC_CHARACTER := E_1A;
CU1      : constant EBCDIC_CHARACTER := E_1B;
IFS      : constant EBCDIC_CHARACTER := E_1C;
DS       : constant EBCDIC_CHARACTER := E_20;
SOS      : constant EBCDIC_CHARACTER := E_21;
WUS      : constant EBCDIC_CHARACTER := E_23;
BYP      : constant EBCDIC_CHARACTER := E_24;
INP      : constant EBCDIC_CHARACTER := E_24;
LF       : constant EBCDIC_CHARACTER := E_25;
SA       : constant EBCDIC_CHARACTER := E_28;
SFE      : constant EBCDIC_CHARACTER := E_29;
SM       : constant EBCDIC_CHARACTER := E_2A;
SW       : constant EBCDIC_CHARACTER := E_2A;
CSP      : constant EBCDIC_CHARACTER := E_2B;

```



```

MFA      : constant EBCDIC_CHARACTER := E_2C;
IR       : constant EBCDIC_CHARACTER := E_33;
PP       : constant EBCDIC_CHARACTER := E_34;
TRN      : constant EBCDIC_CHARACTER := E_35;
NBS      : constant EBCDIC_CHARACTER := E_36;
SBS      : constant EBCDIC_CHARACTER := E_38;
IT       : constant EBCDIC_CHARACTER := E_39;
RFF      : constant EBCDIC_CHARACTER := E_3A;
CU3      : constant EBCDIC_CHARACTER := E_3B;
RSP      : constant EBCDIC_CHARACTER := E_41;
CENT     : constant EBCDIC_CHARACTER := E_4A;
SHY      : constant EBCDIC_CHARACTER := E_CA;
HOOK     : constant EBCDIC_CHARACTER := E_CC;
FORK     : constant EBCDIC_CHARACTER := E_CE;
NSP      : constant EBCDIC_CHARACTER := E_E1;
CHAIR    : constant EBCDIC_CHARACTER := E_EC;
EO       : constant EBCDIC_CHARACTER := E_FF;

```

```

E_0      : constant EBCDIC_CHARACTER := nul;
E_1      : constant EBCDIC_CHARACTER := soh;
E_2      : constant EBCDIC_CHARACTER := stx;
E_3      : constant EBCDIC_CHARACTER := etx;
E_5      : constant EBCDIC_CHARACTER := ht;
E_7      : constant EBCDIC_CHARACTER := del;
E_B      : constant EBCDIC_CHARACTER := vt;
E_C      : constant EBCDIC_CHARACTER := np;
E_D      : constant EBCDIC_CHARACTER := cr;
E_E      : constant EBCDIC_CHARACTER := so;
E_F      : constant EBCDIC_CHARACTER := si;
E_10     : constant EBCDIC_CHARACTER := dle;
E_11     : constant EBCDIC_CHARACTER := dc1;
E_12     : constant EBCDIC_CHARACTER := dc2;
E_13     : constant EBCDIC_CHARACTER := dc3;
E_15     : constant EBCDIC_CHARACTER := nl;
E_16     : constant EBCDIC_CHARACTER := bs;
E_18     : constant EBCDIC_CHARACTER := can;
E_19     : constant EBCDIC_CHARACTER := em;
E_1D     : constant EBCDIC_CHARACTER := gs;
E_1E     : constant EBCDIC_CHARACTER := rs;
E_1F     : constant EBCDIC_CHARACTER := us;
E_23     : constant EBCDIC_CHARACTER := fs;
E_26     : constant EBCDIC_CHARACTER := etb;
E_27     : constant EBCDIC_CHARACTER := esc;
E_2D     : constant EBCDIC_CHARACTER := enq;
E_2E     : constant EBCDIC_CHARACTER := ack;
E_2F     : constant EBCDIC_CHARACTER := bel;
E_32     : constant EBCDIC_CHARACTER := syn;
E_37     : constant EBCDIC_CHARACTER := eot;
E_3C     : constant EBCDIC_CHARACTER := dc4;
E_3D     : constant EBCDIC_CHARACTER := nak;
E_3F     : constant EBCDIC_CHARACTER := sub;

```

```

E_40      : constant EBCDIC_CHARACTER := sp;
E_4B      : constant EBCDIC_CHARACTER := ' ';
E_4C      : constant EBCDIC_CHARACTER := '<';
E_4D      : constant EBCDIC_CHARACTER := '(';
E_4E      : constant EBCDIC_CHARACTER := '+';
E_4F      : constant EBCDIC_CHARACTER := '|';
E_50      : constant EBCDIC_CHARACTER := '&';
E_5A      : constant EBCDIC_CHARACTER := '!';
E_5B      : constant EBCDIC_CHARACTER := '$';
E_5C      : constant EBCDIC_CHARACTER := '"';
E_5D      : constant EBCDIC_CHARACTER := ')';
E_5E      : constant EBCDIC_CHARACTER := ',';
E_5F      : constant EBCDIC_CHARACTER := '~';
E_60      : constant EBCDIC_CHARACTER := '-';
E_61      : constant EBCDIC_CHARACTER := '/';
E_6B      : constant EBCDIC_CHARACTER := ';';
E_6C      : constant EBCDIC_CHARACTER := '%';
E_6D      : constant EBCDIC_CHARACTER := '_';
E_6E      : constant EBCDIC_CHARACTER := '>';
E_6F      : constant EBCDIC_CHARACTER := '?';
E_79      : constant EBCDIC_CHARACTER := '"';
E_7A      : constant EBCDIC_CHARACTER := ':';
E_7B      : constant EBCDIC_CHARACTER := '#';
E_7C      : constant EBCDIC_CHARACTER := '@';
E_7D      : constant EBCDIC_CHARACTER := '"';
E_7E      : constant EBCDIC_CHARACTER := '=';
E_7F      : constant EBCDIC_CHARACTER := '"';
E_81      : constant EBCDIC_CHARACTER := 'a';
E_82      : constant EBCDIC_CHARACTER := 'b';
E_83      : constant EBCDIC_CHARACTER := 'c';
E_84      : constant EBCDIC_CHARACTER := 'd';
E_85      : constant EBCDIC_CHARACTER := 'e';
E_86      : constant EBCDIC_CHARACTER := 'f';
E_87      : constant EBCDIC_CHARACTER := 'g';
E_88      : constant EBCDIC_CHARACTER := 'h';
E_89      : constant EBCDIC_CHARACTER := 'i';
E_91      : constant EBCDIC_CHARACTER := 'j';
E_92      : constant EBCDIC_CHARACTER := 'k';
E_93      : constant EBCDIC_CHARACTER := 'l';
E_94      : constant EBCDIC_CHARACTER := 'm';
E_95      : constant EBCDIC_CHARACTER := 'n';
E_96      : constant EBCDIC_CHARACTER := 'o';
E_97      : constant EBCDIC_CHARACTER := 'p';
E_98      : constant EBCDIC_CHARACTER := 'q';
E_99      : constant EBCDIC_CHARACTER := 'r';
E_A1      : constant EBCDIC_CHARACTER := 's';
E_A2      : constant EBCDIC_CHARACTER := 's';
E_A3      : constant EBCDIC_CHARACTER := 't';
E_A4      : constant EBCDIC_CHARACTER := 'u';
E_A5      : constant EBCDIC_CHARACTER := 'v';
E_A6      : constant EBCDIC_CHARACTER := 'w';
E_A7      : constant EBCDIC_CHARACTER := 'x';

```

```

E_A8      : constant EBCDIC_CHARACTER := 'y';
E_A9      : constant EBCDIC_CHARACTER := 'z';
E_AD      : constant EBCDIC_CHARACTER := '{';
E_BD      : constant EBCDIC_CHARACTER := '|';
E_C0      : constant EBCDIC_CHARACTER := '[';
E_C1      : constant EBCDIC_CHARACTER := 'A';
E_C2      : constant EBCDIC_CHARACTER := 'B';
E_C3      : constant EBCDIC_CHARACTER := 'C';
E_C4      : constant EBCDIC_CHARACTER := 'D';
E_C5      : constant EBCDIC_CHARACTER := 'E';
E_C6      : constant EBCDIC_CHARACTER := 'F';
E_C7      : constant EBCDIC_CHARACTER := 'G';
E_C8      : constant EBCDIC_CHARACTER := 'H';
E_C9      : constant EBCDIC_CHARACTER := 'I';
E_D0      : constant EBCDIC_CHARACTER := 'J';
E_D1      : constant EBCDIC_CHARACTER := 'K';
E_D2      : constant EBCDIC_CHARACTER := 'L';
E_D3      : constant EBCDIC_CHARACTER := 'M';
E_D4      : constant EBCDIC_CHARACTER := 'N';
E_D5      : constant EBCDIC_CHARACTER := 'O';
E_D6      : constant EBCDIC_CHARACTER := 'P';
E_D7      : constant EBCDIC_CHARACTER := 'Q';
E_D8      : constant EBCDIC_CHARACTER := 'R';
E_D9      : constant EBCDIC_CHARACTER := 'S';
E_E0      : constant EBCDIC_CHARACTER := 'T';
E_E2      : constant EBCDIC_CHARACTER := 'U';
E_E3      : constant EBCDIC_CHARACTER := 'V';
E_E4      : constant EBCDIC_CHARACTER := 'W';
E_E5      : constant EBCDIC_CHARACTER := 'X';
E_E6      : constant EBCDIC_CHARACTER := 'Y';
E_E7      : constant EBCDIC_CHARACTER := 'Z';
E_F0      : constant EBCDIC_CHARACTER := '0';
E_F1      : constant EBCDIC_CHARACTER := '1';
E_F2      : constant EBCDIC_CHARACTER := '2';
E_F3      : constant EBCDIC_CHARACTER := '3';
E_F4      : constant EBCDIC_CHARACTER := '4';
E_F5      : constant EBCDIC_CHARACTER := '5';
E_F6      : constant EBCDIC_CHARACTER := '6';
E_F7      : constant EBCDIC_CHARACTER := '7';
E_F8      : constant EBCDIC_CHARACTER := '8';
E_F9      : constant EBCDIC_CHARACTER := '9';

```

```

type EBCDIC_STRING is array (POSITIVE range <>) of EBCDIC_CHARACTER;

```

```

function ASCII_TO_EBCDIC (S : STRING) return EBCDIC_STRING;

```

```

-- CONSTRAINT_ERROR is raised if E_STRING'LENGTH /= A_STRING'LENGTH;
procedure ASCII_TO_EBCDIC (A_STRING : in STRING;
                           E_STRING : out EBCDIC_STRING);

```

```

function EBCDIC_TO_ASCII (S : EBCDIC_STRING) return STRING;

-- CONSTRAINT_ERROR is raised if E_STRING'LENGTH < A_STRING'LENGTH.
procedure EBCDIC_TO_ASCII (E_STRING : in EBCDIC_STRING;
                           A_STRING : out STRING);

end EBCDIC;

```

The procedures `ASCII_TO_EBCDIC` and `EBCDIC_TO_ASCII` are much more efficient than the corresponding functions, as they do not make use of the program heap. Note that if the *in* and *out* string parameters are of different lengths (i.e. `A_STRING'LENGTH = E_STRING'LENGTH`), the procedures will raise the exception `CONSTRAINT_ERROR`.

8.4 Package `OS_ENV`

The implementation-defined package `OS_ENV` enables an Ada program to communicate with the environment in which it is executed.

The specification of this package is as follows:

```

package OS_ENV is

  subtype EXIT_STATUS is INTEGER;

  function ARG_LINE return STRING;

  procedure ARG_LINE (LINE : out STRING;
                     LAST : out NATURAL);

  function ARG_START return NATURAL;

  procedure SET_EXIT_STATUS (STATUS : in EXIT_STATUS);

  procedure ABORT_PROGRAM (STATUS : in EXIT_STATUS);

end OS_ENV;

```

The exit status of the program (returned in register 15 on exit) can be set by a call of `SET_EXIT_STATUS`. Subsequent calls of `SET_EXIT_STATUS` will overwrite the exit status, which is by default 0. If `SET_EXIT_STATUS` is not called, a positive exit code may be set by the Ada Run-Time Executive if an unhandled exception is propagated out of the main subprogram, or if a deadlock situation is detected.

The following exit codes relate to unhandled exceptions:

Exception	Code	Cause of exception
<code>NUMERIC_ERROR</code> :	1	divide by zero

CONSTRAINT_ERROR:	2	numeric overflow
	3	discriminant error
	4	lower bound index error
	5	upper bound index error
	6	length error
STORAGE_ERROR:	7	lower bound range error
	8	upper bound range error
	9	null access value
	10	frame overflow (overflow on subprogram entry)
	11	stack overflow (overflow otherwise)
PROGRAM_ERROR:	12	heap overflow
	13	access before elaboration
	14	function left without return
SPURIOUS_ERROR:		
NUMERIC_ERROR	15-20	<an erroneous program>
CONSTRAINT_ERROR	21	(other than for the above reasons)
	22	(other than for the above reasons)
	23-24	<unused>
	25	static exception (any exception raised as the result of a raise statement)

Code 100 is used if a deadlocking situation is detected and the program is aborted as a result.

Codes 1000-1999 are used to indicate other anomalous conditions in the initialisation of the program, messages concerning which are displayed on the terminal.

9 Characteristics of Numeric Types

9.1 Integer Types

The ranges of values for integer types declared in package STANDARD are as follows:

SHORT_INTEGER	-32768 .. 32767	-- 2**15 - 1
INTEGER	-2147483648 .. 2147483647	-- 2**31 - 1

For the packages DIRECT_IO and TEXT_IO, the ranges of values for types COUNT and POSITIVE_COUNT are as follows:

COUNT	0 .. 2147483647	-- 2**31 - 1
POSITIVE_COUNT	1 .. 2147483647	-- 2**31 - 1

For the package TEXT_IO, the range of values for the type FIELD is as follows:

FIELD	0 .. 255	-- 2**8 - 1
-------	----------	-------------

9.2 Floating Point Type Attributes

SHORT_FLOAT

DIGITS	6
MANTISSA	21
EMAX	84
EPSILON	2.0 ** -20
SMALL	2.0 ** -85
LARGE	2.0 ** 84 * (1.0 - 2.0 ** -21)
SAFE_EMAX	252
SAFE_SMALL	2.0 ** -253
SAFE_LARGE	2.0 ** 127 * (1.0 - 2.0 ** -21)
FIRST	-2.0 ** 252 * (1.0 - 2.0 ** -24)
LAST	2.0 ** 252 * (1.0 - 2.0 ** -24)
MACHINE_RADIX	16
MACHINE_MANTISSA	6
MACHINE_EMAX	63
MACHINE_EMIN	-64
MACHINE_ROUND	FALSE
MACHINE_OVERFLOW	TRUE
SIZE	32

FLOAT

DIGITS	15
MANTISSA	51
EMAX	204
EPSILON	2.0 ** -50
SMALL	2.0 ** -205
LARGE	2.0 ** 204 * (1.0 - 2.0 ** -51)
SAFE_EMAX	252
SAFE_SMALL	2.0 ** -253
SAFE_LARGE	2.0 ** 252 * (1.0 - 2.0 ** 51)
FIRST	-2.0 ** 252 * (1.0 - 2.0 ** -56)
LAST	2.0 ** 252 * (1.0 - 2.0 ** -56)
MACHINE_RADIX	16
MACHINE_MANTISSA	14
MACHINE_EMAX	63
MACHINE_EMIN	-64
MACHINE_ROUND	FALSE

MACHINE_OVERFLOWS	TRUE
SIZE	64

LONG_FLOAT

DIGITS	18
MANTISSA	61
EMAX	244
EPSILON	$2.0 ** -60$
SMALL	$2.0 ** -245$
LARGE	$2.0 ** 244 * (1.0 - 2.0 ** -61)$
SAFE_EMAX	252
SAFE_SMALL	$2.0 ** -253$
SAFE_LARGE	$2.0 ** 252 * (1.0 - 2.0 ** -61)$
FIRST	$-2.0 ** 252 * (1.0 - 2.0 ** -112)$
LAST	$2.0 ** 252 * (1.0 - 2.0 ** -112)$
MACHINE_RADIX	16
MACHINE_MANTISSA	28
MACHINE_EMAX	63
MACHINE_EMIN	-64
MACHINE_ROUNDS	FALSE
MACHINE_OVERFLOWS	TRUE
SIZE	128

9.3 Attributes of Type DURATION

DURATION'DELTA	$2.0 ** -14$
DURATION'SMALL	$2.0 ** -14$
DURATION'LARGE	131072.0
DURATION'FIRST	-86400.0
DURATION'LAST	86400.0

10 Other Implementation-Dependent Characteristics

10.1 Characteristics of the Heap

All objects created by allocators go into the heap. Also, portions of the Ada Run-Time Executive's representation of task objects, including the task stacks, are allocated in the heap.

All objects whose visibility is linked to a subprogram or block have their storage reclaimed at exit.

Use of UNCHECKED_DEALLOCATION on a task object may lead to unpredictable results.

10.2 Characteristics of Tasks

The default task stack size is 16 Kbytes, but by using the Binder option TASK the size for all task stacks in a program may be set to any size from 4 Kbytes to 16 Mbytes.

Timeslicing is implemented for task scheduling. The default time slice is 1000 milliseconds, but by using the Binder option SLICE the time slice may be set to any period of 10 milliseconds or more. It is also possible to use this option to specify no timeslicing, i.e. tasks are scheduled only at explicit synchronisation points. Timeslicing is started only upon activation of the first task in the program, so the SLICE option has no effect for sequential programs.

Normal priority rules are followed for preemption, where PRIORITY values run in the range 1 .. 10. All tasks with "undefined" priority (no pragma PRIORITY) are considered to have a priority of 0.

The minimum timeable delay is 10 milliseconds.

The maximum number of active tasks is limited only by memory usage. Tasks release their storage allocation as soon as they have terminated.

The acceptor of a rendezvous executes the accept body code in its own stack. A rendezvous with an empty accept body (e.g. for synchronisation) does not cause a context switch.

The main program waits for completion of all tasks dependent on library packages before terminating. Such tasks may select a terminate alternative only after completion of the main program.

Abnormal completion of an aborted task takes place immediately, except when the abnormal task is the caller of an entry that is engaged in a rendezvous. Any such task becomes abnormally completed as soon as the rendezvous is completed.

If a global deadlock situation arises because every task (including the main program) is waiting for another task, the program is aborted and the state of all tasks is displayed.

10.3 Definition of a Main Program

A main program must be a non-generic, parameterless, library procedure.

10.4 Ordering of Compilation Units

The Alsys IBM 370 Ada Compiler imposes no additional ordering constraints on compilations beyond those required by the language. However, if a generic unit is instantiated during a compilation, its body must be compiled prior to the completion of that compilation [10.3].

11 Limitations

11.1 Compiler Limitations

- The maximum identifier length is 255 characters.
- The maximum line length is 255 characters.
- The maximum number of unique identifiers per compilation unit is 1500.
- The maximum number of compilation units in a library is 1023.
- The maximum number of subunits per compilation unit is 100.
- The maximum size of the generated code for a single program unit (subprogram or task body) is 128 Kbytes.
- There is no limit (apart from machine addressing range) on the size of the generated code for a single compilation unit.
- There is no limit (apart from machine addressing range) on the size of a single array or record object.
- The maximum size of a single stack frame is 64 Kbytes including the data for inner package subunits which is "unnested" to the parent frame.
- The maximum amount of data in the global data area of a single compilation unit is 64 Kbytes, including compiler-generated data.

APPENDIX C

TEST PARAMETERS

Certain tests in the ACVC make use of implementation-dependent values, such as the maximum length of an input line and invalid file names. A test that makes use of such values is identified by the extension .TST in its file name. Actual values to be substituted are identified by names that begin with a dollar sign. A value must be substituted for each of these names before the test is run. The values used for this validation are given below.

NAME AND MEANING	VALUE
\$BIG_ID1 Identifier the size of the maximum input line length with varying last character.	A....A1 ---- 254 characters
\$BIG_ID2 Identifier the size of the maximum input line length with varying last character.	A....A2 ---- 254 characters
\$BIG_ID3 Identifier the size of the maximum input line length with varying middle character.	A....A3A....A ---- ---- 127 127 characters
\$BIG_ID4 Identifier the size of the maximum input line length with varying middle character.	A....A4A....A ---- ---- 127 127 characters
\$BIG_INT_LIT An integer literal of value 298 with enough leading zeroes so that is is the size of the maximum line length.	0....0298 ---- 252 characters
\$BIG_REAL_LIT A real literal that can be either of floating- or fixed- point type, has value of 690.0, and has enough leading zeroes to be the size of the maximum line length.	0....69.0E1 ---- 249 characters

NAME AND MEANING	VALUE
\$BLANKS A sequence of blanks twenty characters fewer than the size of the maximum line length.	235 blanks
\$COUNT_LAST A universal integer literal whose value is TEXT_IO.COUNT'LAST.	2_147_483_647
\$EXTENDED_ASCII_CHARS A string literal containing all the ASCII characters with printable graphics that are not in the basic 55 Ada character set.	"abcdefghijklmnopqrstuvwxyz !\$%?@[\\]^'{}~"
\$FIELD_LAST A universal integer literal whose value is TEXT_IO.FIELD'LAST	255
\$FILE_NAME_WITH_BAD_CHARS An illegal external file name that either contains invalid characters or is too long if no invalid characters exist.	T??????? LISTING A1
\$FILE_NAME_WITH_WILD_CARD_CHAR An external file name that either contains a wild card character or is too long if no wild card characters exists.	TOOLONGNAME LISTING A1
\$GREATER_THAN_DURATION A universal real value that lies between DURATION'BASE'LAST and DURATION'LAST if any, otherwise any value in in the range of DURATION.	100_000.0
\$GREATER_THAN_DURATION_BASE_LAST The universal real value that is greater than DURATION'BASE'LAST, if such a value exists.	10_000_000.0
\$ILLEGAL_EXTERNAL_FILE_NAME1 An illegal external file name.	T??????? LISTING A1

TEST PARAMETERS

NAME AND MEANING	VALUE
\$ILLEGAL_EXTERNAL_FILE_NAME2 An illegal external file name that is different from \$ILLEGAL_EXTERNAL_FILE_NAME1.	TOOLONGNAME LISTING A1
\$INTEGER_FIRST The universal integer literal expression whose value is INTEGER'FIRST.	-2_147_483_648
\$INTEGER_LAST The universal integer literal expression whose value is INTEGER'LAST.	2_147_483_647
\$LESS_THAN_DURATION A universal real value that lies between DURATION'BASE'FIRST and DURATION'FIRST if any, otherwise any value in the range of DURATION.	-100_000.0
\$LESS_THAN_DURATION_BASE_FIRST The universal real value that is less than DURATION'BASE'FIRST, if such a value exists.	-10_000_000.0
\$MAX_DIGITS The universal integer literal whose value is the maximum digits supported for floating-point types.	18
\$MAX_IN_LEN The universal integer literal whose value is the maximum input line length permitted by the implementation.	255
\$MAX_INT The universal integer literal whose value is SYSTEM.MAX_INT.	2_147_483_647
\$NAME A name of a predefined numeric type other than FLOAT, INTEGER, SHORT_FLOAT, SHORT_INTEGER, LONG_FLOAT, or LONG_INTEGER if one exists, otherwise any undefined name.	NO_SUCH_TYPE

TEST PARAMETERS

NAME AND MEANING	VALUE
<p>\$NEG_BASED_INT</p> <p>A based integer literal whose highest order nonzero bit falls in the sign bit position of the representation for SYSTEM.MAX_INT.</p>	8#200000000000#
<p>\$NON_ASCII_CHAR_TYPE</p> <p>An enumerated type definition for a character type whose literals are the identifier NON_NULL and all non_ASCII characters with printable graphics.</p>	(NON_NULL)

APPENDIX D

WITHDRAWN TESTS

Some tests are withdrawn from the ACVC because they do not conform to the Ada Standard. The following 19 tests had been withdrawn at the time of validation testing for the reasons indicated. A reference of the form "AI-ddddd" is to an Ada Commentary.

- . C32114A: An unterminated string literal occurs at line 62.
- . B33203C: The reserved word "IS" is misspelled at line 45.
- . C34018A: The call of function G at line 114 is ambiguous in the presence of implicit conversions.
- . C35904A: The elaboration of subtype declarations SFX3 and SFX4 may raise NUMERIC_ERROR instead of CONSTRAINT_ERROR as expected in the test.
- . B37401A: The object declarations at lines 126 through 135 follow subprogram bodies declared in the same declarative part.
- . C41404A: The values of 'LAST and 'LENGTH are incorrect in the if statements from line 74 to the end of the test.
- . B45116A: ARRPRIBL 1 and ARRPRIBL 2 are initialized with a value of the wrong type--PRIBOOL_TYPE instead of ARRPRIBOOL_TYPE--at line 41.
- . C48008A: The assumption that evaluation of default initial values occurs when an exception is raised by an allocator is incorrect according to AI-00397.
- . B49006A: Object declarations at lines 41 and 50 are terminated incorrectly with colons, and end case; is missing from line 42.
- . B4A010C: The object declaration in line 18 follows a subprogram body of the same declarative part.

WITHDRAWN TESTS

- . B74101B: The begin at line 9 causes a declarative part to be treated as a sequence of statements.
- . C87B50A: The call of "/"= at line 31 requires a use clause for package A.
- . C92005A: The "/"= for type PACK.BIG_INT at line 40 is not visible without a use clause for the package PACK.
- . C940ACA: The assumption that allocated task TT1 will run prior to the main program, and thus assign SPYNUMB the value checked for by the main program, is erroneous.
- . CA3005A..D: No valid elaboration order exists for these tests.
(4 tests)
- . BC3204C: The body of BC3204C0 is missing.

END

DATE

FILM

4-88

DTIC